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(54) **CADENCE EDITING**

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386/4; 386/52
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(56) **References Cited**

U.S. PATENT DOCUMENTS

5,754,248 A	*	5/1998	Faroudja	....	348/441
5,821,991 A	*	10/1998	Kwok	....	348/459
5,828,786 A	*	10/1998	Rao et al.	....	348/439
5,844,618 A	*	12/1998	Horiike et al.	....	348/441
5,872,600 A	*	2/1999	Suzuki	....	348/459
5,929,902 A	*	7/1999	Kwok	....	348/459
5,978,035 A	*	11/1999	Geshwind	....	348/441
6,072,542 A	*	6/2000	Wilcox et al.	....	348/700
6,115,499 A	*	9/2000	Wang et al.	....	348/439
6,298,090 B1	*	10/2001	Challapali et al.	.....	375/240.26

FOREIGN PATENT DOCUMENTS

EP	0428073 A2	*	11/1990	....	H04N/7/01
EP	0 428 073 A2		11/1990		
EP	0 730 378 A2		2/1996		
EP	0730378 A2	*	2/1996	....	H04N/7/01
EP	0 849 736 A1		12/1997		
EP	0849736 A1	*	12/1997	....	G11B/27/031
EP	PCT/US00/22960		* 12/2000		
WO	WO-94/01971		* 1/1994	....	H04N/7/01
WO	WO 94/01971		1/1994		
WO	WO 97/39577		10/1997		
WO	WO-97/39577		* 10/1997	....	H04N/7/01

OTHER PUBLICATIONS

Dickson, S., et al., "The Gemini Process: A Theatrical–Quality Video–to–Film Transfer Process," 23rd Annual SMPTE Television Conference, Feb. 3–4, 1989, pp. 30–35.*
EPO International Search Report, PCT/US00/22960, Dec. 19, 2000.

* cited by examiner

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(57) **ABSTRACT**

A method for reordering an edited digital video sequence composed of digital video fields from multiple sources is disclosed. When the digital video sequence is reordered temporal cadence is provided which will allow for the conversion to a digital film format through a reverse 3:2 pulldown. Let $F^{old}=(F_1^{old}, F_2^{old}, \ldots, F_N^{old})$ be the given edited sequence of video fields. In one embodiment, the method calculates an instruction set which is then used to transform F^{old} into a new sequence of video fields, denoted F^{new}, where most of the fields in F^{new} come from F^{old} and the remaining fields are "upconverted" fields from F^{old}. This reconstitution of F^{old} is obtained by optimizing a set of instructions based on various constraints which express the characteristics of the pattern AaBbBcCdDd. By assigning a cost to each violation of the constraints, and to each disruption of the natural flow of time, and to other undesirable properties, a real-valued function is constructed. This real valued function can then be optimized through dynamic programming.

71 Claims, 11 Drawing Sheets